CLAIMS

I claim:

1. A vortex nozzle, comprising:

a nozzle body including a passageway therethrough and a plurality of ports that inlet a fluid flow into the passageway; and

an end cap attached to the nozzle body.

2. The vortex nozzle according to claim 1 wherein the passageway is a tapered passageway.

3. The vortex nozzle according to claim 2 wherein the tapered passageway includes an inlet side and an outlet side.

4. The vortex nozzle according to claim 3 wherein the inlet side of the tapered passageway includes a taper at an angle substantially equal to the angle of the taper of the tapered passageway.

5. The vortex nozzle according to claim 2 wherein each of the plurality of ports is tangential to the tapered passageway.

6. The vortex nozzle according to claim 2 wherein each of the plurality of ports enters the tapered passageway at an angle substantially equal to the angle of the taper of the tapered passageway.

7. The vortex nozzle according to claim 3 wherein the cross-sectional area of each of the plurality of ports is less than the cross-sectional area of the inlet side of the tapered passageway.

8. The vortex nozzle according to claim 1 wherein the plurality of ports is substantially equally spaced radially about the nozzle body.

9. The vortex nozzle according to claim 1 wherein the plurality of ports is substantially trapezoidal in shape.

10. The vortex nozzle according to claim 2 wherein the end cap includes an inner face having a taper at an angle substantially equal to the angle of the taper of the tapered passageway.

11. The vortex nozzle according to claim 1 wherein the end cap includes a boss that extends into the passageway and is adapted to adjust force vector components of the fluid flow entering the passageway.

12. The vortex nozzle according to claim 1 wherein the nozzle body is substantially cylindrical in shape and includes a shoulder having a raised portion.

13. A vortex nozzle, comprising:

a nozzle body including a passageway therethrough and a port that inlets a fluid flow into the passageway, whereby the port is tangential to the passageway; and

an end cap attached to the nozzle body.

14. The vortex nozzle according to claim 13 wherein the passageway is a tapered passageway.

15. The vortex nozzle according to claim 14 wherein the tapered passageway includes an inlet side and an outlet side.

16. The vortex nozzle according to claim 15 wherein the inlet side of the tapered passageway includes a taper at an angle substantially equal to the angle of the taper of the tapered passageway.

17. The vortex nozzle according to claim 14 wherein the port is tangential to the tapered passageway.

18. The vortex nozzle according to claim 14 wherein the port enters the tapered passageway at an angle substantially equal to the angle of the taper of the tapered passageway.

19. The vortex nozzle according to claim 15 wherein the cross-sectional area of the port is less than the cross-sectional area of the inlet side of the tapered passageway.

20. The vortex nozzle according to claim 13 wherein the port is substantially trapezoidal in shape.

21. The vortex nozzle according to claim 14 wherein the end cap includes an inner face having a taper at an angle substantially equal to the angle of the taper of the tapered passageway.

22. The vortex nozzle according to claim 13 wherein the end cap includes a boss that extends into the passageway and is adapted to adjust force vector components of the fluid flow entering the passageway.

23. The vortex nozzle according to claim 13 wherein the nozzle body is substantially cylindrical in shape and includes a shoulder having a raised portion.

24. A fluid treating apparatus, comprising:

a first vortex nozzle including a passageway therethrough and a plurality of ports that inlet a first fluid flow into the passageway, whereby the first vortex nozzle imparts a rotation to the first fluid flow thereby creating a first rotated fluid flow; and

a second vortex nozzle positioned in opposed relation the first vortex nozzle, the second vortex nozzle including a passageway therethrough and a plurality of ports that inlet a second fluid flow into the passageway, whereby the second vortex nozzle imparts a rotation to the second fluid flow thereby creating a second rotated fluid flow collided with the first rotated fluid flow.

25. A fluid treating apparatus, comprising:

a first vortex nozzle including a passageway therethrough and a port that inlets a first fluid flow tangentially to the passageway, whereby the first vortex nozzle imparts a rotation to the first fluid flow thereby creating a first rotated fluid flow; and

a second vortex nozzle positioned in opposed relation the first vortex nozzle, the second vortex nozzle including a passageway therethrough and a port that inlets a second fluid flow tangentially to the passageway, whereby the second vortex nozzle imparts a rotation to the second fluid flow thereby creating a second rotated fluid flow collided with the first rotated fluid flow.

26. The fluid treating apparatus according to claim 25 wherein the port of the first vortex nozzle inlets the first fluid flow normal to the passageway.

27. The fluid treating apparatus according to claim 25 wherein the port of the second vortex nozzle inlets the second fluid flow normal to the passageway.

28. A method of treating a fluid, comprising:

positioning a first vortex nozzle in opposed relation to a second vortex nozzle;

inletting a first fluid flow into a passageway of the first vortex nozzle via a plurality of ports of the first vortex nozzle, whereby the first vortex nozzle imparts a rotation to the first fluid flow thereby creating a first rotated fluid flow; and

inletting a second fluid flow into a passageway of the second vortex nozzle via a plurality of ports of the second vortex nozzle, whereby the second vortex nozzle imparts a rotation to the second fluid flow thereby creating a second rotated fluid flow collided with the first rotated fluid flow.

29. A method of treating a fluid, comprising:

positioning a first vortex nozzle in opposed relation to a second vortex nozzle;

inletting a first fluid flow tangentially into a passageway of the first vortex nozzle via a port of the first vortex nozzle, whereby the first vortex nozzle imparts a rotation to the first fluid flow thereby creating a first rotated fluid flow; and

inletting a second fluid flow tangentially into a passageway of the second vortex nozzle via a port of the second vortex nozzle, whereby the second vortex nozzle imparts a rotation to the second fluid flow thereby creating a second rotated fluid flow collided with the first rotated fluid flow.

30. The method according to claim 29, further comprising inletting the first fluid flow normal to the passageway of the first vortex nozzle via the port of the first vortex nozzle.

31. The method according to claim 29, further comprising inletting the second fluid flow normal to the passageway of the second vortex nozzle via the port of the second vortex nozzle.

32. A method of rotating a fluid, comprising:

inletting a fluid flow into a passageway of a vortex nozzle via a plurality of ports; and

rotating the fluid flow in the passageway.

33. The method according to claim 32, further comprising inletting the fluid flow tangentially to the passageway.

34. The method according to claim 32, wherein the passageway is tapered, and the fluid flow is inlet at an angle substantially equal to the taper.

35. A method of rotating a fluid, comprising:

inletting a fluid flow tangentially into a passageway of a vortex nozzle; and

rotating the fluid flow in the passageway.

36. The method according to claim 35, further comprising inletting the fluid flow normal to the passageway.

37. The method according to claim 35, wherein the passageway is tapered, and the fluid flow is inlet at an angle substantially equal to the taper.

38. A vortex nozzle, comprising:

a nozzle body including a passageway;

at least a segment of the passageway being tapered; and

a plurality of ports that inlet a fluid flow into the passageway.

39. The vortex nozzle according to claim 38, wherein at least one of the plurality of ports is tangential to the tapered passageway.

40. The vortex nozzle according to claim 38, wherein at least one of the plurality of ports enters the tapered passageway at an angle substantially equal to the angle of the taper of the tapered passageway.

41. The vortex nozzle according to claim 38, wherein the nozzle body is substantially cylindrical in shape and includes a shoulder having a raised portion.

42. A vortex nozzle, comprising:

a nozzle body including a passageway;

at least a segment of the passageway being tapered; and

a port that inlets a fluid flow into the passageway, the port being tangential to the passageway.

43. The vortex nozzle according to claim 42, wherein the port enters the tapered passageway at an angle substantially equal to the angle of the taper of the tapered passageway.

44. The vortex nozzle according to claim 42, wherein the nozzle body is substantially cylindrical in shape and includes a shoulder having a raised portion.

45. A fluid treatment system, comprising:

a pump;

two opposed vortex nozzles;

a manifold for receiving fluid from the pump and directing it to the nozzles; and

a frame, wherein the pump, nozzles, and manifold are mounted to the frame.

46. The system according to claim 45, wherein the manifold comprises two elbows, and each of the elbows comprises two elbow fittings.

47. A fluid treatment system, comprising:

a pump;

two opposed vortex nozzles; and

a manifold for receiving fluid from the pump and directing it to the nozzles, wherein the manifold comprises two elbows, and each of the elbows comprises two elbow fittings.

48. The fluid treatment system according to claim 47, further comprising a frame on which the nozzles, pump, and manifold are mounted.